Information sheet on
VELVA FRUIT--A NEW FROZEN FRUIT DESSERT

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Recent experimental work at the Western Regional Research Laboratory has shown that the purees of many common fruits can be used in the preparation of an attractive new type of dessert. A suitable mix is prepared and then frozen in an ice cream freezer. To distinguish it from ice cream, sherbet, and ices, the new dessert has been named "Velva Fruit."

The nutritive value, flavor, color, and texture of the product are all noteworthy. Since the major ingredient is the flesh of fruit, the dessert contains the nutritive constituents of fruit in substantial amounts. The fruit flesh is an important food substance rather than simply a flavoring material. Retention of the vitamins has been found to be highly satisfactory, both during the manufacture and over long periods of storage in the frozen state.

The colors and flavors are those of the natural fruits, with only slight modifications. No artificial coloring or flavoring is required. The texture is essentially the same as that of ice cream. Smooth texture is obtained by the action of the ice cream freezer, which incorporates air into the mix. An increase in volume or "overrun" of about 100 percent, as a result of the action of the freezer, results in excellent texture. Velva Fruit differs from ices and sherbets in having a much higher content of fruit puree and a much greater overrun. Ices and sherbets usually contain not more than 20 percent of fruit puree or juice by weight, while Velva Fruit contains over 60 percent. Sherbets contain milk solids, which are not present in Velva Fruit. Ices and sherbets have 25 to 40 percent overrun, while Velva Fruit has 80 to 100 percent.

Whether or not the new dessert will gain acceptance will of course depend on many factors. At present the amount of butterfat available for ice cream has been reduced by about one-third, and this situation may continue during the war. On the other hand, stocks of commercial frozen fruit puree are not sufficiently large at present to enable producers to make commercial quantities. Ultimately ice cream producers may find the new product a valuable additional line and not essentially a competitor with ice cream, and consumers may become convinced that the new product is of sufficient nutritive value to justify its place in the diet. Fruit growers may find a readier market for fruit purees, which are made from the flesh of sound but otherwise unmarketable fruits, than they have found in the past, and commercial handling of frozen fruit purees may become more extensive than it has been heretofore.

Composition and Preparation

The mix is composed of frozen fruit puree, sugar, stabilizer, and, when desirable, citric acid. It can be made with fresh puree and stored as frozen mix or it can be made from frozen stored puree. That is, either the fruit processor or the manufacturer of the frozen dessert can make the mix.

If the ice cream manufacturer uses prepared mix he need only defrost it and then run it through an ice cream freezer. If he prepares the mix, he must defrost the puree and add sugar and a stabilizer before it is frozen. The product is hardened after it has been frozen, and then packaged and stored. Aging of the mix is not necessary. The required drawing-off temperature ranges between 18° and 25°F.

The manufacturer must use care in defrosting a frozen puree or a frozen mix. Many frozen fruits, if unblanched, will tend to oxidize, darken, and acquire off-flavors if they become warm. The simplest method of defrosting is to hold the puree in a cool room below 50°F. Most defrosted purees can stand several days of holding at temperatures below 40°F. The principal causes of deterioration during long storage at this temperature are fermentation, mold growth, and enzymic surface discoloration. If rapid defrosting is desired, packages made of tin can be placed in cold running water. If the puree is packaged in fiberboard, the packaging material can be torn off and the frozen puree chopped up, or ground in a large sausage grinder if available. The chopped or ground mass can be transferred to enameled 30-pound cans or stainless-steel, enameled, or porcelain buckets or tanks, which can be placed in a stream of tap water. Stirring the chopped mass will increase the rate of defrosting. Berries and fruits that contain anthocyanin pigment must not be left in tinned containers, because blue anthocyanin salts would be formed. Contact with the tinned surface of a grinder is not serious because the fruit is very cold and time of contact is short.

Formulas

For best results, the formula for the new dessert must be varied slightly for different fruits, but one of the following typical formulas will usually prove satisfactory:

1. The following formula is used with unsugared fruit puree with high acid and low pectin content--such as raspberries, boysenberries, loganberries, youngberries, Santa Rosa plums, strawberries, and similar fruits. To make approximately 100 gallons of mix, combine the following ingredients:

Puree - - - - - - - - - - - -	640 lbs.
Sucrose - - - - - - - - - - - -	265 lbs.
Gelatin (275 Bloom) - - - - -	5 lbs., 13 oz.
Water - - - - - - - - - - - -	60 lbs.

(Mix the gelatin and water, sterilize, and add.)

In general, with these highly acid fruits no citric acid need be added. An exception is strawberries, which can be improved occasionally by the addition of not over 0.2 percent (1 lb., 14 oz.) of citric acid to the mix. The soluble solids content, including the sugar in the fruit, should be about 37 to 38 percent. Sugar should be added in approximately the ratio of 1 part for every 2.4 parts of fruit puree. High-conversion corn sirup can be substituted for one-third of the sugar, in which case slightly less fruit is necessary to make 100 gallons of mix. The corn sirup must be substituted for the sugar in a 3-to-2 ratio in order to maintain the same sweetness. With the sirup the formula becomes:

Puree - - - - - - - - - - - -	610 lbs.
Sucrose - - - - - - - - - - -	170 lbs.
High-conversion corn sirup - -	125 lbs.
Gelatin (275 Bloom) - - - - - -	5 lbs., 13 oz.
Water - - - - - - - - - - - -	60 lbs.

(Mix the gelatin and water, sterilize, and add.)

2. The following formula is used for fruits with low acid and high pectin content, such as unsugared apricots, cantaloupe, pears, or other naturally sweet fruits. To make approximately 100 gallons of mix, combine the following:

Puree - - - - - - - - - - - -	680 lbs.
Sucrose - - - - - - - - - - -	225 lbs.
Gelatin (275 Bloom) - - - - - -	5 lbs., 13 oz.
Water - - - - - - - - - - - - -	60 lbs.
Citric acid - - - - - - - - - -	1 lb., 14 oz.

A soluble solids content of 34 to 35 percent, including the natural sugar of the fruit, is sufficient because of the lower acid content of these fruits. A 3-to-1 ratio of fruit to sugar is usually satisfactory, though even less sugar can sometimes be used.

In the preparation of a mix, the puree, sugar, and citric acid (if used) are mixed together until well dissolved. Keeping the puree and the mix cool and avoidance of excessive mixing tend to preserve the ascorbic acid of the fruit. The gelatin is mixed with ten times its weight of water, and is heated to 170°-180°F. to dissolve and sterilize it. The mix itself is not pasteurized. During the addition of the gelatin sol the mix is stirred in order to prevent the formation of stringy gelatin in the mix. Here again excessive mixing is avoided. If a batch freezer is used, the gelatin sol can be stirred into the mix in the freezer before the refrigerant is added.

The Office of Price Administration permits the addition of sugar in varying amounts to frozen pureed fruits, and most fruits are packed with the maximum amount allowed. The amounts permitted are presented below, together with the additional amount required in the preparation of the dessert. The allowable amounts of sugar tabulated below are quoted from Amendment 102 (Nov. 18, 1943) to Ration Order No. 3, Section 1407-241, Schedule A, Table IV, August 28, 1942. These amounts are of course subject to amendment.

To prepare 100 gallons of mix, combine:

Fruit	Sugar allowed by OPA	Fruit plus sugar at OPA ceiling sugar content	Additional sugar
	Ratio fruit to sugar	Lbs.	Lbs.
Apples	5 : 1	815	90
Apricots	3 : 1	905	0
Blackberries	No sugar	640	265
Boysenberries	No sugar	640	265
Cantaloupe	No sugar	680	225

(tabulation continued)

(tabulation concluded)

Fruit	Sugar allowed by OPA	Fruit plus sugar at OPA ceiling sugar content	Additional sugar
	Ratio fruit to sugar	Lbs.	Lbs.
Loganberries	No sugar	640	265
Nectarines	3 : 1	905	0
Peaches	3 : 1	905	0
Pears	3 : 1	905	0
Plums: all types	4 : 1	800	105
Prunes (a type of plum)	4 : 1	905	0
Raspberries	4 : 1	800	105
Strawberries	3 : 1	850	55
Youngberries	No sugar	640	265

The sugar content of Velva Fruit gives it about the same hardness at low temperatures as that of ice cream under similar conditions. There is some variation with the type of fruit, however; desserts made from berries, for example, are softer than those made from pulpy fruits such as peaches.

Tests to compare the rate of melting of Velva Fruit with that of good-quality ice cream (14 percent butterfat and 100 percent overrun), were made by placing samples of equal weights of youngberry Velva Fruit (containing sucrose) and ice cream on separate 8-mesh screens at room temperature. Figures 1 and 2 show that the fruit dessert melted no faster than the ice cream. The fruit dessert did not drain as completely as the ice cream because it does not melt to a liquid as does the ice cream; a good deal of foam remains. Foam is not considered desirable in ice cream but does not detract from the fruit dessert. With ice cream it is important to avoid a "foamy collapsing feeling" in the mouth caused by too much overrun and too little body. Velva Fruit has sufficient body to prevent this sensation.

Stabilizer and Overrun

The added stabilizer must produce an overrun of about 100 percent with small, compact air cells. With an overrun of this amount a much smoother and better-textured product is obtained than with a lower overrun, as in ices and sherbets. Stabilizers suitable for ices and sherbets may not produce the overrun desired here, but 275 Bloom gelatin has proved satisfactory and has the added advantage of availability under present conditions. The desired overrun is easily obtained with the amount and type of gelatin given in the formulas except for very viscous purees. For very pulpy fruits a lesser quantity of gelatin (0.4 percent) frequently suffices.

Experiments with Velva Fruit have indicated that the mix need not be aged. According to Sommer[1] aging ice cream mixes has a beneficial effect by allowing a

[1] H. H. Sommer: The Theory and Practice of Ice Cream Making. Olson Publishing Co., Milwaukee, 1938.

partial denaturation of the milk proteins. Since Velva Fruit contains very little protein, this delay is unnecessary.

It is possible that a certain amount of delay would be desirable in order to permit complete hydration of the gelatin. This possibility was tested by assuming that the viscosity of the mix is a measure of the gelatin hydration. The results of the experiment are plotted in Figure 3. An amount of gelatin sufficient to provide a 0.6 percent concentration was dissolved in ten volumes of water and heated to 170°F. The gelatin sol was then added with stirring into a youngberry mix, sweetened with sucrose, and held in a room at 34° to 36°F. The viscosity was measured with a Brookfield synchronized motor viscometer.

It is evident that the maximum viscosity is attained in 40 to 50 minutes. Actually the maximum hydration can be attained much sooner. The mix was warmed slightly by the addition of the hot gelatin sol. A part of the increase in viscosity was due to the normal cooling of the mix back to 36°F. It may not be necessary to attain the maximum degree of hydration in order to get the proper overrun. A satisfactory 100-percent overrun has been attained in a small one-gallon batch freezer, when the elapsed time after the addition of gelatin sol was only 5 to 10 minutes.

The overrun varies somewhat with the fruit. Desserts prepared from buttery purees, such as peach and apricot, tend to be dry and "grainy" when too much overrun is introduced. About 80 to 90 percent is satisfactory for this type of puree. These flavors are too delicate to stand great dilution. Highly flavored berry and plum desserts, in contrast, have had good texture and flavor with 100 to 110 percent overrun. Since the mixes have a different viscosity from ice cream mixes, the proper overrun settings on continuous ice cream freezers may have to be determined by experiment.

Sugar Substitutes

The type of sugar substitute that is suitable varies with the fruit. Corn sirups and other substitutes containing dextrins make the dessert stiffer and more melt-resistant and give it more body. Corn sugar (dextrose) will not do this. Sirups should not be used with fruits high in pectin content, such as apricots, peaches, prunes, and nectarines, which are already quite stiff and melt-resistant. Sirups can be used with berry purees, since they have a thinner consistency and can use the extra stiffening properties. Corn sugar has been found undesirable for use in frozen berries because it imparts a bluish cast.

Substitute sugar is not required in Velva Fruit to stabilize the sucrose and prevent its crystallization, as in ices. The higher amount of stabilizer and fruit solids in these desserts prevents such crystallization. Crystallization has not occurred during accelerated storage tests over a period of six months. Velva Fruit desserts can probably be stored for longer periods than ice cream. No "shrinkage" was noted during six-months' storage of Velva Fruit in 3-1/2-ounce waxed paper cups.

Useful Varieties

Almost any fruit with a pronounced flavor can be used in making Velva Fruit. The desserts prepared from the common berries (raspberries, strawberries, loganberries, boysenberries, youngberries) have been outstanding. They possess a smooth texture and a pronounced berry flavor. Tree fruits such as apricot, Santa Rosa plum, and fresh prune (French plum) produce fine desserts, which are very smooth-textured and well flavored. Cantaloupe puree has produced a remarkably fine frozen dessert, and is available in considerable surplus. Fruits, such as peaches and nectarines, with less pronounced flavor, have produced desserts with a smooth texture but a more delicate flavor.

Blends can be prepared by mixing the less available and more expensive berries with the less expensive but more available tree fruits such as pear and apple. The best blending tree fruit tested has been Hardy pear. Though the pear does not have a strong flavor by itself and has not produced good desserts when used alone, its flavor is of a particular aromatic quality that carries over very well in blends. One of the best fruit blends thus far prepared is a half-and-half mixture of Hardy pear and Cuthbert raspberry. The pears must be finely ground and passed through a pulper screen with holes not over 0.026-inch in diameter; if the holes are larger, small bits of peel will pass through and cause a gritty texture. The blending can be done by the dessert manufacturer more easily than by the packer of frozen fruits because all fruits do not ripen at the same time; for example pears ripen later than the berries.

Nutritive Value of Velva Fruit

Since the dessert is kept cold at all times, it retains essentially all of the nutritive and health-regulating qualities of the fruit puree, such as vitamins, minerals, and other natural constituents. The vitamin A in yellow-fleshed peaches, apricots and cantaloupes is maintained intact, and the ascorbic acid is retained well. It has been found with berry puree, for example, that a loss of less than 10 percent of the ascorbic acid occurred during preparation of the mix, accelerated aging for 15 hours, freezing, hardening, packaging, and storage for 3 months in 3-1/2-ounce paper containers. It was found that most of the loss occurred during the aging, which can be omitted.

Some loss of ascorbic acid occurs during the pureeing of the fruit preliminary to freezing, and the extent of the loss varies with the temperature and condition of the fruit, the type of pulper employed, and the enzyme system of the fruit being pureed. Tests showed that raspberries and strawberries lost no ascorbic acid during pureeing in the type of pulper that incorporates little air--that is, one using a pressing rather than a beating action. Cantaloupes lost from a fourth to a half of their ascorbic acid content during pureeing in this recommended type of pulper. Consecutive pulping to obtain a high puree recovery and delay before freezing caused the greater losses. Pureeing in a disintegrator rapidly destroyed all the ascorbic acid present. Since the variety of cantaloupe used contains 48 to 50 milligrams of ascorbic acid per 100 grams, these losses become significant.

While Velva Fruit has essentially all of the ascorbic acid of the puree, it thus lacks some of the ascorbic acid of the whole fruit because of loss during

pureeing. Desserts prepared from such berries as loganberries, youngberries, and raspberries have averaged 10 to 15 milligrams of ascorbic acid per 100 grams, while that made from strawberries has averaged 40 milligrams per 100 grams. The ascorbic acid content is decreased to the extent of the dilution with sugar. Since cantaloupe and similar low-acid purees are made considerably more acid during the mixing, the losses during preparation and storage of the finished product are small in comparison with losses during pureeing. The retention of ascorbic acid during the manufacture of strawberry Velva Fruit is discussed in a separate paper which will be published later.

Since these desserts have a pH that retains ascorbic acid and since they are kept at low temperatures, they are an ideal vehicle for fortification with synthetic ascorbic acid. Loganberry puree, fortified with synthetic ascorbic acid to contain 60 milligrams of ascorbic acid per 100 grams of dessert, lost less than 1 milligram per 100 grams during 4 months' storage in 3-1/2-ounce paper containers.

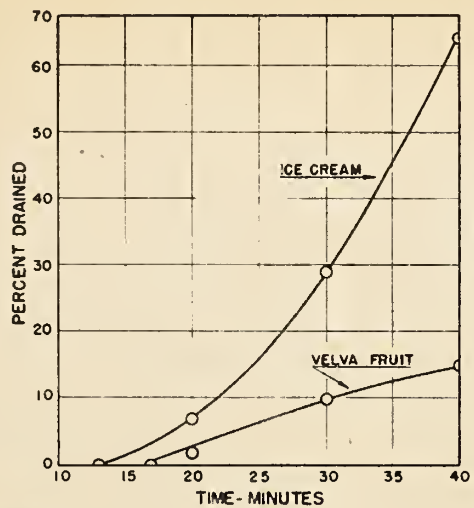

Fig. 1
Rates of melting of ice cream and Velva Fruit when brought from $-10^{\circ}F$. into a room at $75^{\circ}F$.

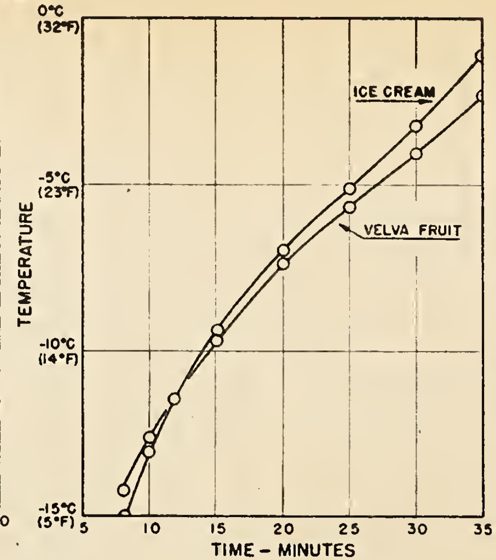

Fig. 2
Rates of warming of ice cream and Velva Fruit when brought from $-10^{\circ}F$. into a room at $75^{\circ}F$. Only portions of the curves are shown.

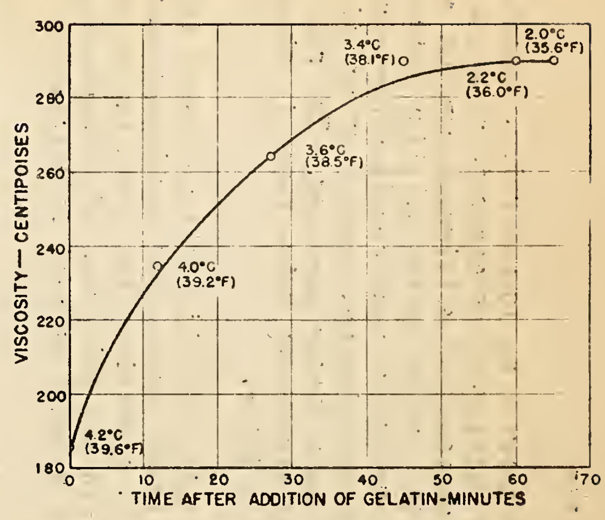

Fig. 3
Increase in viscosity of a Velva Fruit mix as a result of addition of a sol of 275 Bloom gelatin.